SEQUENCE LISTING

<110> Thompson, Mark
Knuth, Mark
Cardineau, Guy

<120> Bacillus thuringiensis Toxins with Improved Activity

<130> MA-702D2

<150> US 09/222,594
<151> 1998-12-28

<150> US 08/904,278
<151> 1998-07-31

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<170> PatentIn version 3.1

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<212> DNA
<213> Bacillus thuringiensis

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aaacaagaat gggctacgat tggagcatat attcagactg gattaggttt accagtaaat 180

gaacaacaat taagaacaca tgttaattta agtcaggata tatcaatacc tagtgatttt 240

tctcaattat atgatgttta ttgttctgat aaaacttcag cagaatggtg gaataaaaat 300

ttatatcctt taattattaa atctgctaat gatattgctt catatggttt taaagttgct 360

ggtgatcctt ctattaagaa agatggatat tttaaaaaat tgcaagatga attagataat 420

attgttgata ataattccga tgatgatgca atagctaaag ctattaaaga ttttaaagcg 480

cgatgtggta ttttaattaa agaagctaaa caatatgaag aagctgcaaa aaatattgta 540

acatctttag atcaattttt acatggtgat cagaaaaaat tagaaggtgt tatcaatatt 600

caaaaacgtt taaaagaagt tcaaacagct cttaatcaag cccatgggga aagtagtcca 660

gctcataaag agttattaga aaaagtaaaa aatttaaaaa caacattaga aaggactatt 720

aaagctgaac aagatttaga gaaaaaagta gaatatagtt ttctattagg accattgtta 780

ggatttgttg tttatgaaat tcttgaaaat actgctgttc agcatataaa aaatcaaatt 840

gatgagataa agaaacaatt agattctgct cagcatgatt tggatagaga tgttaaaatt 900

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gcaattaaag ttttccaaaa gttacaaggt atttgggcta ctattggagc tcaaatagaa 1020

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attgaacttg aggacgcttc tgatgcttgg ttagttgtgg ctcaagaagc tcgtgatttt 1140

acactaaatg cttattcaac taatagtaga caaaatttac cgattaatgt tatatcagat 1200

tcatgtaatt gttcaacaac aaatatgaca tcaaatcaat acagtaatcc aacaacaaat 1260

atgacatcaa atcaatatat gatttcacat gaatatacaa gtttaccaaa taattttatg 1320

ttatcaagaa atagtaattt agaatataaa tgtcctgaaa ataatttttat gatatattgg 1380

tataataatt cggattggta taataattcg gattggtata ataat 1425

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<211> 475
<212> PRT
<213> Bacillus thuringiensis

<400> 2

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Thr Ile Lys Leu Asn Ser Asn Lys Lys Tyr Gly Pro Gly Asp Met Thr
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Asn Gly Asn Gln Phe Ile Ile Ser Lys Gln Glu Trp Ala Thr Ile Gly
35 40 45

Ala Tyr Ile Gln Thr Gly Leu Gly Leu Pro Val Asn Glu Gln Gln Leu
50 55 60

Arg Thr His Val Asn Leu Ser Gln Asp Ile Ser Ile Pro Ser Asp Phe
65 70 75 80

Ser Gln Leu Tyr Asp Val Tyr Cys Ser Asp Lys Thr Ser Ala Glu Trp
85 90 95

Trp Asn Lys Asn Leu Tyr Pro Leu Ile Ile Lys Ser Ala Asn Asp Ile
100 105 110

Ala Ser Tyr Gly Phe Lys Val Ala Gly Asp Pro Ser Ile Lys Lys Asp
115 120 125

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Gly Tyr Phe Lys Lys Leu Gln Asp Glu Leu Asp Asn Ile Val Asp Asn
    130                 135                 140

Asn Ser Asp Asp Asp Ala Ile Ala Lys Ala Ile Lys Asp Phe Lys Ala
145                 150                 155                 160

Arg Cys Gly Ile Leu Ile Lys Glu Ala Lys Gln Tyr Glu Glu Ala Ala
                165                 170                 175

Lys Asn Ile Val Thr Ser Leu Asp Gln Phe Leu His Gly Asp Gln Lys
            180                 185                 190

Lys Leu Glu Gly Val Ile Asn Ile Gln Lys Arg Leu Lys Glu Val Gln
        195                 200                 205

Thr Ala Leu Asn Gln Ala His Gly Glu Ser Ser Pro Ala His Lys Glu
    210                 215                 220

Leu Leu Glu Lys Val Lys Asn Leu Lys Thr Thr Leu Glu Arg Thr Ile
225                 230                 235                 240

Lys Ala Glu Gln Asp Leu Glu Lys Lys Val Glu Tyr Ser Phe Leu Leu
                245                 250                 255

Gly Pro Leu Leu Gly Phe Val Val Tyr Glu Ile Leu Glu Asn Thr Ala
            260                 265                 270

Val Gln His Ile Lys Asn Gln Ile Asp Glu Ile Lys Lys Gln Leu Asp
        275                 280                 285

Ser Ala Gln His Asp Leu Asp Arg Asp Val Lys Ile Ile Gly Met Leu
    290                 295                 300

Asn Ser Ile Asn Thr Asp Ile Asp Asn Leu Tyr Ser Gln Gly Gln Glu
305                 310                 315                 320

Ala Ile Lys Val Phe Gln Lys Leu Gln Gly Ile Trp Ala Thr Ile Gly
                325                 330                 335

Ala Gln Ile Glu Asn Leu Arg Thr Thr Ser Leu Gln Glu Val Gln Asp
            340                 345                 350
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Ser Asp Asp Ala Asp Glu Ile Gln Ile Glu Leu Glu Asp Ala Ser Asp
355 360 365

Ala Trp Leu Val Val Ala Gln Glu Ala Arg Asp Phe Thr Leu Asn Ala
370 375 380

Tyr Ser Thr Asn Ser Arg Gln Asn Leu Pro Ile Asn Val Ile Ser Asp
385 390 395 400

Ser Cys Asn Cys Ser Thr Thr Asn Met Thr Ser Asn Gln Tyr Ser Asn
405 410 415

Pro Thr Thr Asn Met Thr Ser Asn Gln Tyr Met Ile Ser His Glu Tyr
420 425 430

Thr Ser Leu Pro Asn Asn Phe Met Leu Ser Arg Asn Ser Asn Leu Glu
435 440 445

Tyr Lys Cys Pro Glu Asn Asn Phe Met Ile Tyr Trp Tyr Asn Asn Ser
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Asp Trp Tyr Asn Asn Ser Asp Trp Tyr Asn Asn
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<212> DNA
<213> Bacillus thuringiensis

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aagcaagaat gggccacgat tggcgcatac attcagactg gactcggctt accagtgaat 180

gagcaacagc tgagaaccca cgttaacctt agtcaagaca tcagcatacc atctgacttt 240

tctcaactct acgatgtgta ttgttctgac aagactagtg cagaatggtg gaacaagaat 300

ctctatcctt tgatcatcaa gtctgccaat gacattgctt catatggttt caaagttgct 360

ggtgatcctt cgatcaagaa agatggttac ttcaagaagc ttcaagatga actcgacaac 420

attgttgaca acaactccga cgacgatgcg atagccaaag ccatcaagga cttcaaagca 480

agatgtggca ttctcatcaa ggaagccaag cagtatgaag aagctgccaa gaacattgta 540

acatcattgg atcagtttct ccatggagac cagaagaagc tcgagggtgt catcaacatt 600

cagaaacgtc tgaaagaggt tcaaacagct ctgaatcaag cccatgggga atccagtcca 660

gctcacaaag agcttcttga gaaagtgaag aacttgaaga ccacacttga gaggaccatc 720

aaagctgaac aagacttgga gaagaaagta gagtacagct ttctacttgg acccttgtta 780

ggctttgttg tctacgagat tcttgagaac actgctgttc aacacatcaa gaatcaaatc 840

gatgagatca agaaacagtt ggattctgcg caacatgact tggatcgcga tgtgaagatc 900

attggaatgc tcaacagcat caacactgac attgacaact tgtatagtca aggacaagaa 960

gcaatcaaag tctttcagaa gctacaaggg atatgggcca ctattggagc tcagatagag 1020

aatcttcgca ccacgtccct tcaagaagtc caagactctg atgatgctga tgagatacag 1080

attgaacttg aggacgcatc tgatgcatgg ttagttgtgg ctcaagaagc tcgtgacttc 1140

acactgaatg cctactcaac caacagtcga cagaatctcc cgatcaatgt gatctcagat 1200

tcatgcaatt gctccaccac caacatgaca tccaatcagt acagcaatcc aacaaccaac 1260

atgactagca atcagtacat gattagccat gagtatacca gcttgcccaa caacttcatg 1320

ttgtcaagga attcgaacct ggagtacaag tgccctgaga acaacttcat gatctactgg 1380

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<212> PRT
<213> Bacillus thuringiensis

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Thr Ile Lys Leu Asn Ser Asn Lys Lys Tyr Gly Pro Gly Asp Met Thr
20 25 30

Asn Gly Asn Gln Phe Ile Ile Ser Lys Gln Glu Trp Ala Thr Ile Gly
35 40 45

Ala Tyr Ile Gln Thr Gly Leu Gly Leu Pro Val Asn Glu Gln Gln Leu
50 55 60

Arg Thr His Val Asn Leu Ser Gln Asp Ile Ser Ile Pro Ser Asp Phe
65 70 75 80

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Ser Gln Leu Tyr Asp Val Tyr Cys Ser Asp Lys Thr Ser Ala Glu Trp
                85                  90                  95

Trp Asn Lys Asn Leu Tyr Pro Leu Ile Ile Lys Ser Ala Asn Asp Ile
            100                 105                 110

Ala Ser Tyr Gly Phe Lys Val Ala Gly Asp Pro Ser Ile Lys Lys Asp
        115                 120                 125

Gly Tyr Phe Lys Lys Leu Gln Asp Glu Leu Asp Asn Ile Val Asp Asn
    130                 135                 140

Asn Ser Asp Asp Asp Ala Ile Ala Lys Ala Ile Lys Asp Phe Lys Ala
145                 150                 155                 160

Arg Cys Gly Ile Leu Ile Lys Glu Ala Lys Gln Tyr Glu Glu Ala Ala
                165                 170                 175

Lys Asn Ile Val Thr Ser Leu Asp Gln Phe Leu His Gly Asp Gln Lys
            180                 185                 190

Lys Leu Glu Gly Val Ile Asn Ile Gln Lys Arg Leu Lys Glu Val Gln
        195                 200                 205

Thr Ala Leu Asn Gln Ala His Gly Glu Ser Ser Pro Ala His Lys Glu
    210                 215                 220

Leu Leu Glu Lys Val Lys Asn Leu Lys Thr Thr Leu Glu Arg Thr Ile
225                 230                 235                 240

Lys Ala Glu Gln Asp Leu Glu Lys Lys Val Glu Tyr Ser Phe Leu Leu
                245                 250                 255

Gly Pro Leu Leu Gly Phe Val Val Tyr Glu Ile Leu Glu Asn Thr Ala
            260                 265                 270

Val Gln His Ile Lys Asn Gln Ile Asp Glu Ile Lys Lys Gln Leu Asp
        275                 280                 285

Ser Ala Gln His Asp Leu Asp Arg Asp Val Lys Ile Ile Gly Met Leu
    290                 295                 300
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Asn Ser Ile Asn Thr Asp Ile Asp Asn Leu Tyr Ser Gln Gly Gln Glu
305                 310                 315                 320

Ala Ile Lys Val Phe Gln Lys Leu Gln Gly Ile Trp Ala Thr Ile Gly
                325                 330                 335

Ala Gln Ile Glu Asn Leu Arg Thr Thr Ser Leu Gln Glu Val Gln Asp
            340                 345                 350

Ser Asp Asp Ala Asp Glu Ile Gln Ile Glu Leu Glu Asp Ala Ser Asp
        355                 360                 365

Ala Trp Leu Val Val Ala Gln Glu Ala Arg Asp Phe Thr Leu Asn Ala
    370                 375                 380

Tyr Ser Thr Asn Ser Arg Gln Asn Leu Pro Ile Asn Val Ile Ser Asp
385                 390                 395                 400

Ser Cys Asn Cys Ser Thr Thr Asn Met Thr Ser Asn Gln Tyr Ser Asn
                405                 410                 415

Pro Thr Thr Asn Met Thr Ser Asn Gln Tyr Met Ile Ser His Glu Tyr
            420                 425                 430

Thr Ser Leu Pro Asn Asn Phe Met Leu Ser Arg Asn Ser Asn Leu Glu
        435                 440                 445

Tyr Lys Cys Pro Glu Asn Asn Phe Met Ile Tyr Trp Tyr Asn Asn Ser
    450                 455                 460

Asp Trp Tyr Asn Asn Ser Asp Trp Tyr Asn Asn
465                 470                 475
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<212> DNA
<213> Bacillus thuringiensis

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cagactggac tcggcttacc agtgaatgag caacagctga gaacccacgt taaccttagt 180

caagacatca gcataccatc tgacttttct caactctacg atgtgtattg ttctgacaag 240

actagtgcag aatggtggaa caagaatctc tatcctttga tcatcaagtc tgccaatgac 300

attgcttcat atggtttcaa agttgctggt gatccttcga tcaagaaaga tggttacttc 360

aagaagcttc aagatgaact cgacaacatt gttgacaaca actccgacga cgatgcgata 420

gccaaagcca tcaaggactt caaagcaaga tgtggcattc tcatcaagga agccaagcag 480

tatgaagaag ctgccaagaa cattgtaaca tcattggatc agtttctcca tggagaccag 540

aagaagctcg agggtgtcat caacattcag aaacgtctga aagaggttca aacagctctg 600

aatcaagccc atggggaatc cagtccagct cacaaagagc ttcttgagaa agtgaagaac 660

ttgaagacca cacttgagag gaccatcaaa gctgaacaag acttggagaa gaaagtagag 720

tacagctttc tacttggacc cttgttaggc tttgttgtct acgagattct tgagaacact 780

gctgttcaac acatcaagaa tcaaatcgat gagatcaaga aacagttgga ttctgcgcaa 840

catgacttgg atcgcgatgt gaagatcatt ggaatgctca acagcatcaa cactgacatt 900

gacaacttgt atagtcaagg acaagaagca atcaaagtct ttcagaagct acaagggata 960

tgggccacta ttggagctca gatagagaat cttcgcacca cgtcccttca agaagtccaa 1020

gactctgatg atgctgatga gatacagatt gaacttgagg acgcatctga tgcatggtta 1080

gttgtggctc aagaagctcg tgacttcaca ctgaatgcct actcaaccaa cagtcgacag 1140

aatctcccga tcaatgtgat ctcagattca tgcaattgct ccaccaccaa catgacatcc 1200

aatcagtaca gcaatccaac aaccaacatg actagcaatc agtacatgat tagccatgag 1260

tataccagct tgcccaacaa cttcatgttg tcaaggtag 1299

<210> 6
<211> 432
<212> PRT
<213> Bacillus thuringiensis

<400> 6

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Trp Ala Thr Ile Gly Ala Tyr Ile Gln Thr Gly Leu Gly Leu Pro Val
35 40 45

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Asn Glu Gln Gln Leu Arg Thr His Val Asn Leu Ser Gln Asp Ile Ser
    50                  55                  60

Ile Pro Ser Asp Phe Ser Gln Leu Tyr Asp Val Tyr Cys Ser Asp Lys
65                  70                  75                  80

Thr Ser Ala Glu Trp Trp Asn Lys Asn Leu Tyr Pro Leu Ile Ile Lys
                85                  90                  95

Ser Ala Asn Asp Ile Ala Ser Tyr Gly Phe Lys Val Ala Gly Asp Pro
            100                 105                 110

Ser Ile Lys Lys Asp Gly Tyr Phe Lys Lys Leu Gln Asp Glu Leu Asp
        115                 120                 125

Asn Ile Val Asp Asn Asn Ser Asp Asp Asp Ala Ile Ala Lys Ala Ile
    130                 135                 140

Lys Asp Phe Lys Ala Arg Cys Gly Ile Leu Ile Lys Glu Ala Lys Gln
145                 150                 155                 160

Tyr Glu Glu Ala Ala Lys Asn Ile Val Thr Ser Leu Asp Gln Phe Leu
                165                 170                 175

His Gly Asp Gln Lys Lys Leu Glu Gly Val Ile Asn Ile Gln Lys Arg
            180                 185                 190

Leu Lys Glu Val Gln Thr Ala Leu Asn Gln Ala His Gly Glu Ser Ser
        195                 200                 205

Pro Ala His Lys Glu Leu Leu Glu Lys Val Lys Asn Leu Lys Thr Thr
    210                 215                 220

Leu Glu Arg Thr Ile Lys Ala Glu Gln Asp Leu Glu Lys Lys Val Glu
225                 230                 235                 240

Tyr Ser Phe Leu Leu Gly Pro Leu Leu Gly Phe Val Val Tyr Glu Ile
                245                 250                 255

Leu Glu Asn Thr Ala Val Gln His Ile Lys Asn Gln Ile Asp Glu Ile
            260                 265                 270
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Lys Lys Gln Leu Asp Ser Ala Gln His Asp Leu Asp Arg Asp Val Lys
275 280 285

Ile Ile Gly Met Leu Asn Ser Ile Asn Thr Asp Ile Asp Asn Leu Tyr
290 295 300

Ser Gln Gly Gln Glu Ala Ile Lys Val Phe Gln Lys Leu Gln Gly Ile
305 310 315 320

Trp Ala Thr Ile Gly Ala Gln Ile Glu Asn Leu Arg Thr Thr Ser Leu
325 330 335

Gln Glu Val Gln Asp Ser Asp Asp Ala Asp Glu Ile Gln Ile Glu Leu
340 345 350

Glu Asp Ala Ser Asp Ala Trp Leu Val Val Ala Gln Glu Ala Arg Asp
355 360 365

Phe Thr Leu Asn Ala Tyr Ser Thr Asn Ser Arg Gln Asn Leu Pro Ile
370 375 380

Asn Val Ile Ser Asp Ser Cys Asn Cys Ser Thr Thr Asn Met Thr Ser
385 390 395 400

Asn Gln Tyr Ser Asn Pro Thr Thr Asn Met Thr Ser Asn Gln Tyr Met
405 410 415

Ile Ser His Glu Tyr Thr Ser Leu Pro Asn Asn Phe Met Leu Ser Arg
420 425 430

<210> 7
<211> 1140
<212> DNA
<213> Bacillus thuringiensis

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caagacatca gcataccatc tgacttttct caactctacg atgtgtattg ttctgacaag 240

actagtgcag aatggtggaa caagaatctc tatcctttga tcatcaagtc tgccaatgac 300

attgcttcat atggtttcaa agttgctggt gatccttcga tcaagaaaga tggttacttc 360

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gccaaagcca tcaaggactt caaagcaaga tgtggcattc tcatcaagga agccaagcag 480

tatgaagaag ctgccaagaa cattgtaaca tcattggatc agtttctcca tggagaccag 540

aagaagctcg agggtgtcat caacattcag aaacgtctga aagaggttca aacagctctg 600

aatcaagccc atggggaatc cagtccagct cacaaagagc ttcttgagaa agtgaagaac 660

ttgaagacca cacttgagag gaccatcaaa gctgaacaag acttggagaa gaaagtagag 720

tacagctttc tacttggacc cttgttaggc tttgttgtct acgagattct tgagaacact 780

gctgttcaac acatcaagaa tcaaatcgat gagatcaaga aacagttgga ttctgcgcaa 840

catgacttgg atcgcgatgt gaagatcatt ggaatgctca acagcatcaa cactgacatt 900

gacaacttgt atagtcaagg acaagaagca atcaaagtct ttcagaagct acaagggata 960

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gactctgatg atgctgatga gatacagatt gaacttgagg acgcatctga tgcatggtta 1080

gttgtggctc aagaagctcg tgacttcaca ctgaatgcct actcaaccaa cagtcgatag 1140

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<212> PRT
<213> Bacillus thuringiensis

<400> 8

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20 25 30

Trp Ala Thr Ile Gly Ala Tyr Ile Gln Thr Gly Leu Gly Leu Pro Val
35 40 45

Asn Glu Gln Gln Leu Arg Thr His Val Asn Leu Ser Gln Asp Ile Ser
50 55 60

Ile Pro Ser Asp Phe Ser Gln Leu Tyr Asp Val Tyr Cys Ser Asp Lys
65 70 75 80

Thr Ser Ala Glu Trp Trp Asn Lys Asn Leu Tyr Pro Leu Ile Ile Lys
85 90 95

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Ser Ala Asn Asp Ile Ala Ser Tyr Gly Phe Lys Val Ala Gly Asp Pro
            100                 105                 110

Ser Ile Lys Lys Asp Gly Tyr Phe Lys Lys Leu Gln Asp Glu Leu Asp
        115                 120                 125

Asn Ile Val Asp Asn Asn Ser Asp Asp Asp Ala Ile Ala Lys Ala Ile
    130                 135                 140

Lys Asp Phe Lys Ala Arg Cys Gly Ile Leu Ile Lys Glu Ala Lys Gln
145                 150                 155                 160

Tyr Glu Glu Ala Ala Lys Asn Ile Val Thr Ser Leu Asp Gln Phe Leu
                165                 170                 175

His Gly Asp Gln Lys Lys Leu Glu Gly Val Ile Asn Ile Gln Lys Arg
            180                 185                 190

Leu Lys Glu Val Gln Thr Ala Leu Asn Gln Ala His Gly Glu Ser Ser
        195                 200                 205

Pro Ala His Lys Glu Leu Leu Glu Lys Val Lys Asn Leu Lys Thr Thr
    210                 215                 220

Leu Glu Arg Thr Ile Lys Ala Glu Gln Asp Leu Glu Lys Lys Val Glu
225                 230                 235                 240

Tyr Ser Phe Leu Leu Gly Pro Leu Leu Gly Phe Val Val Tyr Glu Ile
                245                 250                 255

Leu Glu Asn Thr Ala Val Gln His Ile Lys Asn Gln Ile Asp Glu Ile
            260                 265                 270

Lys Lys Gln Leu Asp Ser Ala Gln His Asp Leu Asp Arg Asp Val Lys
        275                 280                 285

Ile Ile Gly Met Leu Asn Ser Ile Asn Thr Asp Ile Asp Asn Leu Tyr
    290                 295                 300

Ser Gln Gly Gln Glu Ala Ile Lys Val Phe Gln Lys Leu Gln Gly Ile
305                 310                 315                 320
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Trp Ala Thr Ile Gly Ala Gln Ile Glu Asn Leu Arg Thr Thr Ser Leu
325 330 335

Gln Glu Val Gln Asp Ser Asp Asp Ala Asp Glu Ile Gln Ile Glu Leu
340 345 350

Glu Asp Ala Ser Asp Ala Trp Leu Val Val Ala Gln Glu Ala Arg Asp
355 360 365

Phe Thr Leu Asn Ala Tyr Ser Thr Asn Ser Arg Met
370 375 380

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<211> 1185
<212> DNA
<213> Bacillus thuringiensis

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gacggtttta taatctctaa ggaagaatgg gcatttgtgc aggcctatgt gactacaggc 180

actggtttac ctatcaatga cgatgagatg cgtagacatg ttgggttacc atcacgcatt 240

caaattcctg atgattttaa tcaattatat aaggtttata atgaagataa acatttatgc 300

agttggtgga atggtttctt gtttccatta gttcttaaaa cagctaatga tatttccgct 360

tacggattta aatgtgctgg aaagggtgcc actaaaggat attatgaggt catgcaagac 420

gatgtagaaa atatttcaga taatggttat gataaagttg cacaagaaaa agcacataag 480

gatctgcagg cgcgttgtaa aatccttatt aaggaggctg atcaatataa agctgcagcg 540

gatgatgttt caaaacattt aaacacattt cttaaaggcg gtcaagattc agatggcaat 600

gatgttattg gcgtagaggc tgttcaagta caactagcac aagtaaaaga taatcttgat 660

ggcctatatg gcgacaaaag cccaagacat gaagagttac taaagaaagt agacgacctg 720

aaaaaagagt tggaagctgc tattaaagca gagaatgaat tagaaaagaa agtgaaaatg 780

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gaactcgaca gagatgtaaa aatcttagga atgatgaata gcattgacac tgatattgac 960

aacatgttag agcaaggtga gcaagctctt gttgtattta gaaaaattgc aggcatttgg 1020

agtgttataa gtcttaatat cggcaatctt cgagaaacat ctttaaaaga gatagaagaa 1080

gaaaatgatg acgatgcact gtatattgag cttggtgatg ccgctggtca atggaaagag 1140

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<211> 208
<212> PRT
<213> Bacillus thuringiensis

<400> 10

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20 25 30

Gly Pro Glu Gly Met Val Thr Lys Asp Gly Phe Ile Ile Ser Lys Glu
35 40 45

Glu Trp Ala Phe Val Gln Ala Tyr Val Thr Thr Gly Thr Gly Leu Pro
50 55 60

Ile Asn Asp Asp Glu Met Arg Arg His Val Gly Leu Pro Ser Arg Ile
65 70 75 80

Gln Ile Pro Asp Asp Phe Asn Gln Leu Tyr Lys Val Tyr Asn Glu Asp
85 90 95

Lys His Leu Cys Ser Trp Trp Asn Gly Phe Leu Phe Pro Leu Val Leu
100 105 110

Lys Thr Ala Asn Asp Ile Ser Ala Tyr Gly Phe Lys Cys Ala Gly Lys
115 120 125

Gly Ala Thr Lys Gly Tyr Tyr Glu Val Met Gln Asp Asp Val Glu Asn
130 135 140

Ile Ser Asp Asn Gly Tyr Asp Lys Val Ala Gln Glu Lys Ala His Lys
145 150 155 160

Asp Leu Gln Ala Arg Cys Lys Ile Leu Ile Lys Glu Ala Asp Gln Tyr
165 170 175

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Lys Ala Ala Ala Asp Asp Val Ser Lys His Leu Asn Thr Phe Leu Lys
            180                 185                 190

Gly Gly Gln Asp Ser Asp Gly Asn Asp Val Ile Gly Val Glu Ala Val
        195                 200                 205
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